Appendix A

Results From the First Industry Stakeholder Workshop (September 19, 2002)

A.1 Stakeholder Workshop Description

A workshop was organized and hosted by the Advanced Power and Energy Program (APEP) at UCI to garner help from industrial stakeholders to develop accurate DG implementation scenarios and to adequately consider technologies of interest to the stakeholders. The workshop was characterized as follows:

Workshop Title: ***Distributed Generation Implementation Scenarios for Air Quality Impacts in the South Coast Air Basin***
Workshop Date/Time: Thursday, September 19, 9:00 am to 4:30 pm
Workshop Location: Advanced Power and Energy Program, University of California, Irvine

The purpose of this workshop was to: (1) provide the stakeholders a brief overview of the current air quality impacts of DG project, (2) receive important feedback and guidance from the DG community, (3) accept, critique, and modify program direction and approach appropriately, and (4) better ground the research effort to garner insight into real potential air quality impacts of DG.

The discussion topics of this workshop included:

(1) Program overview and approach
(2) Types of DG considered
(3) Characteristics of DG considered
(4) DG Scenarios development
(5) DG Scenario screening
(6) Examples of air quality impacts

The agenda for the workshop was (discussion/presentation leader in parentheses):

9:00am Introductions/Agenda Review (Prof. Scott Samuelsen)
9:15am Program Overview and Approach (Dr. Jack Brouwer)
9:45am Discussion of DG Types and Characteristics
10:15am Break
10:30am Distributed Generation Scenarios Development and Screening (Dr. Marc Medrano, Dr. Jack Brouwer)
11:00am Discussion of Scenario Development and Screening
11:30am Air Quality Modeling Approach and Sample Results (Prof. Donald Dabdub, Mr. Marc Carreras)
12:00pm Lunch (Establish Breakout Groups)
1:00pm Breakout Sessions (Prof. Scott Samuelsen – red; Dr. Jack Brouwer – green; Dr. Marc Medrano – yellow)
Types of DG considered (20 minutes)
Characteristics of DG considered (20 minutes)
Scenario development strategy (20 minutes)
Scenarios themselves (20 minutes)
Scenario Screening (20 minutes)
Air Quality Issues (20 minutes)
3:00pm Break

3:30pm Summary of breakout sessions (Reports from red, green, & yellow breakout groups)
4:15pm Summary discussion
4:30pm Adjourn

Attendees of the Stakeholder workshop are presented in Table A-1.

Table A-1. List of organizations that attended the DG industry stakeholder workshop held at UCI on September 19, 2002

Organization
SCAQMD
Southern California Edison
Southern California Gas
LADWP
CARB
CEC
FuelCell Energy
UCI
Capstone Turbine Corp.
EPRI
Clean Air Now
Coalition for Clean Air
APEP
O'Conner Consultants
Pacific Gas & Electric
Planenergy
Millennium Cell
UC Berkeley
Elliot Turbines
Alliance Power
Bowman Power Systems

A.2 APEP Compilation and Assessment of Stakeholder Recommendations

The Advanced Power and Energy Program (APEP) of UCI recorded the input from stakeholders at this workshop and compiled the notes that were gathered as a result of the questions raised during the formal presentations, issues discussed, and recommendations made during the full discussion periods and in each of the three breakout sessions, held in the afternoon. From all of this input from stakeholders, APEP researchers compiled and assessed the stakeholder recommendations as follows in this section.

A.2.1 Recommendations to Definitely Include

- For DG spatial distribution:
  - Base distribution on population and population growth. (Population - reflects installed base power and peak power demand, whereas Population Growth reflects emerging opportunities.)
  - Consider zoning/permitting in scenario development.
  - Use economic "models" that are realistic for market penetration (e.g., CHP) – limited per discussion below.
  - Use utility interconnect data and other applicable statistics – if data are available/provided (need cooperation of LADWP, SCE).
  - Use highway miles scenario for model "sensitivity" only.

- For DG temporal distribution:
  - Account for the likelihood that the majority of DG will NOT be base-loaded.

- For DG technology mix:
  - Remove windmills from consideration in the South Coast Air Basin (SoCAB).
  - Natural gas-fired ICEs should be included in the scenarios (check PM emissions rate).
  - For 2010 DG Scenarios, incorporate a population of DG that reflects emissions performance at the date of installation. (Include likely performance degradation)
  - Account for significant adoption of CHP systems (between 40% and 60% - FuelCell Energy, 65% - Capstone) in this timeframe.

- For DG penetration:
  - 20% of increase is most likely "worst case" penetration scenario (not a consensus opinion with many supporting 20%).

- For DG Scenarios in general:
  - Adopt the following DG classifications:
    - Residential: 1 kW to 5 kW (FC, PV)
    - Commercial/Small Industrial: 25 kW to 500 kW (PV, MTG, FC)
    - Large Commercial/Institutional: 500 kW to 2 MW (reciprocating engines)

- Large Institutional: 2 MW to 50 MW (GT)
    - Account for CHP emission offsets (e.g., boiler replacement).
    - Develop baseline scenarios for both the "uncontrolled" and "controlled" 2010 base case emissions inventory (use the latest "release" relative to the project schedule).
    - Strongly differentiate cases that are "forecasts" (i.e., likely or realistic) from those that are "excursions" (i.e., used for engineering insight or brainstorming).
    - Do a few excursions to bracket the problem and capture uncertainty ("you never know").
- For DG Emissions Characterization:
    - For larger systems (> 5MW?) emissions offsets must be purchased and should be included in the scenario.
    - Use the CARB or AQMD standards that apply to the technology, size, and application.
    - Report emissions of CO_2 as a result, but don't use possible CO_2 impacts or regulatory action in development of scenarios (perform a separate DG scenario calculation that accounts for non-regional sources as well).
    - Carefully include an analysis of displaced emissions (especially for CHP, opportunity fuels, etc.).
    - Apply the 2003 and 2007 CARB standards scenarios to the moderate penetration case.

A.2.2 Recommendations to Consider

- For DG Spatial Distribution:
    - Focus on consumption growth to locate power generators.
    - Use current transmission grid constrained locations as a weighting consideration.
- For DG Technology Mix:
    - Solar is not expected to contribute a high percentage of DG, rather, consider solar-thermal combined with heat and power (e.g., Nevada and North Carolina).
    - PV is only residential (But penetration could be increased in commercial applications due to future policy decisions (e.g., AB970 incentives, San Francisco Bond).
    - Add solar-thermal and external combustion engines (e.g., Stirling external combustion engine).
    - Focus on natural gas DG.
    - Categorize and organize as existing technologies and emerging technologies.
    - Consider digester gas installations in the Chino Valley.
    - Consider the use of DG at oil and gas recovery locations.

- Assume that large plants (3–50 MW) are more likely to use gas turbine. 1–3 MW gas turbines and ICE. Below 1 MW plants are more likely to incorporate small DG technology (MTGs, FCs).
- Diesel-fuel-related technology will not be used in the basin in the future.
- Hydrogen ICEs should be considered as another potential source—with H_2 generated "in the basin."
- Consider larger combined cycle plants—could affect DG adoption in vicinity.
- Gas turbine fuel cell hybrid systems will not be widely available by 2010.
- Consider fuel cells vehicles—only as linked to hydrogen production and refueling.

- For DG temporal distribution:
  - Characterize DG based on operational hours, and applications in various market segments (particularly important considering temporal aspects of the simulation)
  - Since majority of DG will NOT be base-loaded (60% not base-loaded), need to define by application and consider time-of-use (TOU) pricing.

- For DG Emissions Characterization:
  - "Worst Case" must include diesel-fueled internal combustion engines (ICE).

- For DG Scenarios in general:
  - Consider applications and market segments when determining both penetration and DG characterization (e.g., chiller, hot water, steam, residential, industrial, commercial).
  - Include economic (value driven) and policy factors in scenario development, including: (1) current economic incentives, (2) renewable portfolio standard, (3) departing load charges, (4) CHP benefits, (5) fuel availability, (6) cost of fuel, (7) applicable covenants, conditions, and restrictions (CC&Rs), (8) zoning / permitting, (9) applicable tariff, in the DG scenario development. (NOTE: this is quite challenging, and could comprise a completely new DG penetration study project—we suggest a limited economic analysis)
  - Up to 15% of the existing load on a substation does not require an upgrade. Above that, there are additional costs, which should be considered as an economic constraint for DG deployment.
  - Limit the cases to a top 10 list, and add sub-cases.
  - Use hydrogen more widely in a brainstorming scenario including hydrogen infrastructure development. While low penetration may be true for 2010, H_2 may be prominent in 2050.

- Include consideration of uninterruptible power supply (UPS), premium power increased demands for DG.
- Consider a "worst case" scenario that allows diesel gen-sets to operate more than 200 hours.
- Divide DG into "clean but polluting" and "non-polluting" categories.
- Correlate results to DG size, type, application:
  - Residential: 1 kW to 5 kW (FC, PV)
  - Commercial/Small Industrial: 25 kW to 500 kW (PV, MTG, FC)
  - Large Commercial/Institutional: 500 kW to 2 MW (reciprocating engines)
  - Large Institutional: 2 MW to 50 MW (GT)

A.2.3 Recommendations to Reject

- Consider multimedia environmental impacts (e.g., noise, EMF, water, soil)
- Consider retiring plants, possible large demand due to lack of merchant plant installations as an opportunity (if not replaced) or discouragement for DG (if replaced).
- Consider fuel cell vehicle emissions in the scenarios.
- Be careful to not analyze two (or more) DGs with same emissions profiles (and end uses).
- Do an emergency generator operating case. (potential overlap with UCR study).
- Consider diesel-fueled DG that can operate continuously in basin.
- Consider doing only emission modeling instead of air quality modeling.

A.2.4 APEP Actions

- Differentiate between regional and local impacts. Local impacts need to be studied closer. Identify where impacts are expected to be stronger.
- Demonstrate early on that DG does have an impact (e.g., model sensitivity to incremental emissions associated with DG).
- Determine if NG reciprocating engines are the same, better than, or worse than MTG.
- Define bounds on the problem. DG might not have an impact even in the worst case.
- Have another meeting to report back to this group of stakeholders.
- Revise natural gas ICE emission factors. They appear to be too high for PM especially.
- VOC emissions for a PEMFC seem too high.
- Need to know how the AQMD, CARB, or EPRI (E2I) will use results, to narrow the span.
- Do 2007 CARB standards include CHP credit?
- How does definition of DG differ from CARB definition? (SB1298)

- Gain access to the "controlled" emission inventory for 2010
  - Get unprocessed emissions inventory
  - Get controlled emissions inventory
- Discuss the better way to approach CHP for the emissions accounting
- Compile more emissions rates from other sources and also partial performance emissions factors.
- Find out which land parcel classification (zoning) information for SoCAB is available in GIS or other formats.
- Try to get information on hourly electricity profiles for industrial, commercial, and residential sub-segments from SoCAB utilities.